

DOE Annual Review
LBNL Physics Division
May 28, 2003

Theory Group

- **Overview**
- **Research: nanoreviews**

M. Chanowitz

LBL Senior Staff

Barnett (PDG/ATLAS), Cahn (BABAR),
Chanowitz*, Hinchliffe (ATLAS)

LBL Divisional Fellow

Ligeti

UCB Faculty

Bardacki, Bousso (1/04), Gaillard, Ganor,
Hall**, Halpern, Horava, Murayama†,
Nomura (11/03), Suzuki

Retired

LBL: Stapp

UCB: Chew, Jackson, Mandelstam,
Zumino

Support staff

Kihanya, Lockhart (60%)

* Group Leader

† NSF Lead PI

** Theory Center Head

LBL staff/UCB faculty function as single unified group:

- Postdocs
- Students
- Visitor's program
- Seminars, e.g.,
 - “strings” Tuesday campus
 - “4-d” Wednesday LBNL
 - Ecumenical Monday alternates

utilizing pooled resources:

- LBNL Physics Div.
- UCB NSF theory grant
- UCB Theory Center
 - UCB endowment (\$1M “seed”)
 - LBNL 5-yr ops support (~\$430K/yr)

Postdocs

Significant expansion in FY '04 from

- Theory Center +3
- UCB Miller Fellow +1
- Ligeti DOE-OJI +1

Converted 3 postdocs to 5-year fellows

Returning*:

G. Burdman		(LBNL)
Z. Chacko	(\longrightarrow 5 yr)	(NSF)
W. Goldberger		(NSF)
M. Perelstein	(\longrightarrow 5 yr)	(LBNL \longrightarrow NSF)
M. Rangamani		(Center)
R. Tatar		(NSF \longrightarrow LBNL)

+ FY '04:

E. Gimon	(5 yr)	(Center)
I. Mitra		(Center)
G. Perez		(OJI)
M. Schwartz		(Center)
T. Watari		(Miller)

*Defections still possible.

Students

GSRA's supported for two years

- LBNL 4
- Center 4

Current Roster:

A. Birkedal-Hansen (MKG)
E. Boyda (PH)
S. Ganguli (PH)
J. Gill (OG)
R. Harnik (HM)
C. Helfgott (MH)
D. Larson (HM)
T. Okui (LH)
S. Oliver (LH)
I. Osipenkov (MKG)
C. Park (MKG)
A. Pasqua (BZ)
U. Varadarajan (BZ)
D. Vasilyuk (OG)

Visitors Program

Provides support for 1 - 3 week visits

- Foster joint research with group members
- FY '03 funding from Center

<u>Name</u>	<u>Dates</u>	<u>Home Institution</u>
Schwarz, John	5/12/02 - 5/17/02	Cal Tech
Nelson, Brent	5/20/02 - 6/05/02	U. of Michigan
Ponton, Eduardo	5/27/02 - 6/7/02	Yale
Dobrescu, Bogdan	6/1/02 - 6/15/02	Yale
Jurco, Branislav	7/30/02 - 8/15/02	U. Munich
Einhorn, Martin	8/5/02 - 8/23/02	U. of Michigan
Drukker, Nadav	11/2/02 - 11/6/02	Weizmann Institute
Armoni, Adi	11/16/02 - 11/24/02	CERN
Ooguri, Hiroshi	12/3/02 - 12/9/02	Cal Tech
Leibovich, Adam	2/2/03 - 2/7/03	Fermilab
Wise, Mark	2/6/03 - 2/9/03	Cal Tech
Narayan, Krishnan	2/10/03 - 2/16/03	Duke
Hiller, Gudrun	3/3/03 - 3/17/03	L-M-U, Munchen
Luty, Markus	3/18/03 - 3/30/03	U. of Maryland
Graesser, Michael	3/24/03 - 4/11/03	Cal Tech
Grojean, Christophe	3/24/03 - 4/11/03	CEA/Saclay
Guralnik, Zachary	3/30/03 - 4/12/03	Humboldt Univ
Wise, Mark	4/4/03 - 4/6/03	Cal Tech
Katz, Emmanuel	4/4/03 - 4/22/03	U. of Washington
Harmark, Troels	4/28/03 - 5/8/03	Harvard
John Terning	5/7/02 - 5/16/02	LANL
Mitra, Indrajit	5/25/03 - 5/31/03	Princeton
Charles Thorn	5/21/03 - 5/31/03	U. of Florida

Outlook

Despite fiscal hard times, Physics Division and LBNL Directorate have strongly supported HEP theory:

- Big LBNL role in faculty recruitment/retention.
- Reduction of LBNL postdocs (4 ---> 2) reversed by Division support of Theory Center.
- Limited resources affect recruitment/retention, e.g., unfavorable comparisons to new theory centers at Harvard and Stanford, with which we are in direct competition.

Director has responded with funds to begin renovation of LBNL theory area.

LBNL theory staff:

- diminished by redirection of effort
- unfilled mandate from previous panels to recruit a senior theorist or Division Fellow

Theorists share division-wide concerns over effect of impending space crunch:

- Coincides with big increase in size of group
- Could affect recruitment/retention
- Renovation delayed

Research

- Traditionally strong in both formal theory and particle physics (aka ‘phenomenology’)
- Recent faculty hires to revitalize formal theory
Fall ‘01: Ganor, Horava
Winter ‘04: Bousso (Asst. Prof.)

- Particle physics

- New hire Fall ‘03: Nomura (Asst. Prof.)
- Strong center of BSM model-building and of theory closely related to experiment.
- Close coupling to experimental program

For instance,

→ Next talk

Co-chair

* Ligeti, Murayama, Cahn participated in Division v study group

* Ligeti strongly coupled to Division’s B Physics programs @BABAR/CDF

* And we have made **the ultimate sacrifice:**

Cahn → BABAR

Hinchliffe → ATLAS

Research examples: “nanoreviews”

Ligeti: seeks to understand heavy flavor physics to better utilize experimental probes, e.g.,

- method to extract CKM angle γ without hadronic uncertainties
- Subleading QCD effects in semilep. B decay and V_{ub}
- SU(3) symmetry relations to test SM CP violation in $B \rightarrow \eta' K_S, \phi K_S, K^+ K^- K_S$

Cahn/Jackson: $D_s(2318, 0^+)$, $D_s(2460, 1^+)$ masses & widths not explicable assuming Coulombic vector potential

Suzuki

- test factorization ansatz using Λ as helicity analyzer in inclusive B decay, $B \rightarrow \Lambda X$
- setting a limit on $D_s(2460, 1^+) \rightarrow D_s \pi \pi$

Murayama: broad research program, e.g.,

- Astrophys. data (WMAP + 2dF GRS) contradict LSND
- SM Higgs as component of extra-dim. gauge fields
- CMB anisotropy from scalar field baryogenesis

Chanowitz

- Precision EW data and the direct lower limit on m_H : problems of SM fit not resolved by assuming sys. error
- Signature of scalar glueball decay

Hinchliffe

- Experimental tests of noncommutative geometry
- SUSY signals at LHC

Hall: extensive studies of extra-dimension scenarios, e.g.,

- Extra-d GUT solution to “classical” GUT problems
- 5-d SUSY with natural TeV-scale SUSY breaking
- θ_w from TeV-scale 5-d quark-lepton unification

Gaillard: connecting Planck-scale string theory to SUGRA, GUT, and TeV-scale physics, e.g., SUGRA effects of anomalous U(1)’s generic to string theories.

Ganor: strings, M-theory, extra-d field theories..., e.g.,

- nonlocal interactions from D-branes in plane-wave backgrounds
- gravity in nonlocal theories and possible significance for the early universe

Zumino: explicit Seiberg-Witten maps relating noncommuting non-Abelian gauge theories to commuting ones.

Halpern

- Large N limit of conformal field theory
- Studies of WZW orbifolds

Bardakci: world sheet formulation of large-N ϕ^3 field theory as prototype for string formulation of QCD.

Horava: string theory/M- theory and cosmological implications, e.g., holographic protection of chronology in string theory cosmologies with closed time-like curves (“Godel-type”)